

## **EFFECT OF TILLAGE ON DOWNY BROME SEED DISTRIBUTION**

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### **INTRODUCTION**

Downy brome (*Bromus tectorum* L.) is a grass weed that is difficult to control in the inland Pacific Northwest dryland wheat farming region. Downy brome is often more difficult to control with conservation tillage systems that leave crop residue on and near the soil surface for erosion control than with inversion tillage (Veseth et al., 1994). This control problem in conservation tillage systems may be partially due to these systems leaving downy brome seeds in a favorable location for seedling emergence.

Downy brome seedlings usually emerge from the top inch of soil but may occasionally emerge from as deep as 4 inches (Wicks et al., 1971). Primary tillage provides a means of burying weed seeds deeper than 4 inches. In long-term tillage plots in Wisconsin, 60 percent of all weed seeds were found in the top 0.4 inches in plots that were not tilled as compared to 30 percent of the seeds in the top 0.4 inches in chisel plowed plots (Yenish et al., 1992). Moldboard plowing evenly distributed weed seeds in the top 7.5 inches. In other tests, 50 percent of foxtail millet (*Setaria italica* L. Beauv.) seeds applied before tillage were found within 1.6 inches of the surface following chisel plowing compared to 10 percent in the moldboard plowed plots (Staricka et al., 1990). Downy brome seeds are less dense and more elongated than the seeds used by Yenish et al. (1992) and Staricka et al. (1990). The lighter and more

elongated downy brome seeds might tend to be more difficult to bury.

This research was conducted to determine downy brome seed distribution in no tillage, chisel plow and moldboard plow based tillage systems.

### **METHODS**

A field experiment with four replications of primary tillage treatments that included chisel plowing 4 inches deep, moldboard plowing 7.5 to 8 inches deep and no tillage (no-till) was conducted on a Walla Walla silt loam at the Columbia Plateau Conservation Research Center, Pendleton, Oregon. The field had been in winter wheat the previous year and wheat stubble was standing when the tests were initiated.

Downy brome seeds were spread on the soil surface with a 40 inch wide Gandy drop spreader prior to tillage. Seeds were spread at of 180 seeds per square foot. Prior to spreading downy brome seeds, they were dyed red to facilitate identification of seeds in the recovery process.

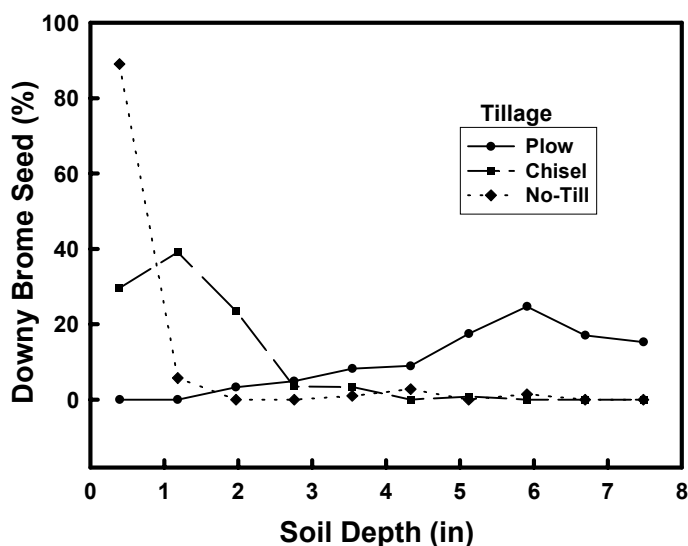
The moldboard plow was a 5 bottom pull type with 16 inch wide bottoms. The chisel plow had 4 inch wide twisted shovels spaced 15 inches apart. Tillage speed was approximately 3 mph. After primary tillage, soil was firmed by skew treading twice with the gangs angled at 15 degrees. A Giddings hydraulic soil sampler was used to collect six, 2.5 inch diameter by 8 inch long vertical soil cores from each plot. The cores were incrementally sliced into 0.8 inch sections and corresponding increments from each plot were composited. Downy brome seeds were extracted from soil cores by a liquid density separation technique (Ball and Miller, 1989). A solution of magnesium

sulfate, sodium hexametaphosphate, sodium bicarbonate, and water was used to separate seeds and plant material from soil. Seeds floated to the top with plant material and were decanted off and caught on filter paper. The dyed downy brome seeds were hand picked from the filter paper and counted.

## RESULTS

As expected, most of the seeds were found in the top increment in the non-disturbed no-till plots (Figure 1). The highest concentrations of weed seeds were at 1 and 6-inch depths, respectively, for chisel plowing and moldboard plowing. Chisel plowing left significantly (0.05 probability

seeds were buried below 4 inches in the moldboard plowed plots (Figure 2). These results are similar to those found by Straicka et al., (1990). They found 85 percent of millet seed and spherical tracers in the top 2 inches in plots that were chisel plowed and 75 percent of the millet seed and tracers below 4 inches in plots that were moldboard plowed. Chisel plowing depth was the same in their tests as ours but moldboard plowing depth was 2 inches deeper than ours. The decreased percentage of seeds below 4 inches in Straicka et al., (1990) tests may be due to tillage speed and moldboard shape that resulted in incomplete furrow inversion. Yenish et al., (1992) measured weed seed distribution in the soil profile



**Figure 1. Percentage of downy brome seeds found in each depth increment for the three tillage systems near Pendleton, Oregon in 1994.**

level) more seeds in the 0 to 2.4 inch depth and significantly less in the 4.8 to 7.2 inch depth than moldboard plowing.

More than 90 percent of the downy brome seeds were found in the top 2 inches in chisel plowed plots and 80 percent of the

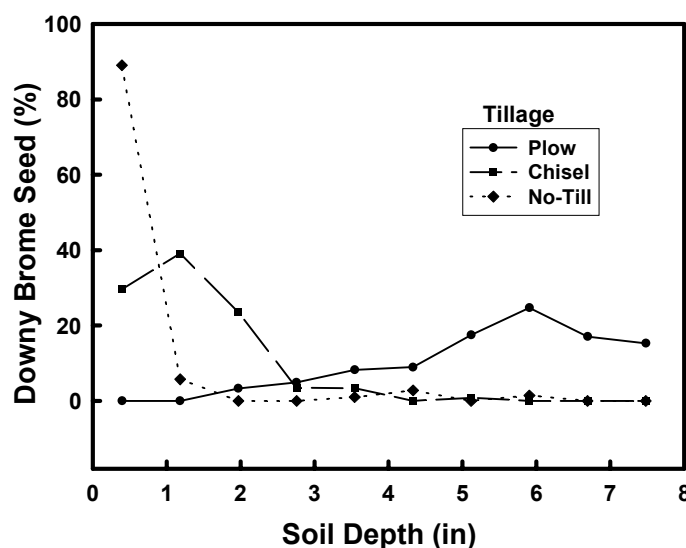
after several years of tillage in long-term plots. They found 57 percent of the weed seeds in the top 2.4 inches in plots that were chisel plowed and 54 percent of the seeds below 3.5 inches in plots that were moldboard plowed. The apparently more uniform weed seed distribution in Yenish et

al., (1992) tests was probably due to the difference in test methods. In the tests conducted by Yenish et al., (1992), all weed seeds in the profile were counted but in the tests reported here only the dyed seeds that were spread on the surface with the drop seeder were counted. Yenish et al., (1992) included seeds that did not germinate or decay and remained in the profile and were subject to possible relocation with subsequent tillage.

selective herbicides and secondary tillage will be necessary to control downy brome.

## REFERENCES

Ball, D. A., and S. D. Miller. 1989. A comparison of techniques for estimation of arable soil seedbanks and their relationship to weed flora. *Weed Research*. 29:365-373.



**Figure 2. Accumulative distribution of downy brome seed near Pendleton, Oregon in 1994.**

## CONCLUSIONS

Downy brome plants establish from shallow placed seeds. Moldboard plowing placed 80 percent of the seeds below 4 inches where they likely will not produce emerged seedlings. Chisel plowing, a conservation tillage technique, left 90 percent of the seeds in the top 2 inches where they can germinate and develop into seedlings. If chisel plowing is used in fields where downy brome has been a problem, additional weed control measures such as

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